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modern California Indians, although no comparative study has yet been made by a specially trained craniologist.

It is not possible in the case of the Hawver Cave relics to prove Quaternary age for the human bones. As in the other instances mentioned, the inference is, however, that the date of their entombment preceded the present day by centuries, if not by millenniums.

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SPECIAL ARTICLES

THE SCIENCE OF EXOTIC MUSIC¹

IF architecture is the king of the fine arts, commanding the outward services of others, music is their queen, imposing the inward laws by which all rule themselves. The notions of harmony, pitch, scale, tonality and key, applied in fine art generally, have in music first become clear enough to receive names. The theory of all the arts awaits to this day the exact grasp of these ideas which the investigation of musical structure will some time give.

¹ A. J. Ellis, "On the Musical Scales of Various Nations," *Journal of the Society of Arts*, XXXIII., 1885. J. P. N. Land, "Ueber die Tonkunst der Javanen," *Vierteljahrsschrift für Musikwissenschaft*, 1889, 1. C. Stumpf, "Lieder der Bellakula Indianern," *Vierteljahrsschrift für Musikwissenschaft*, 1886, 4; "Phonographirter Indianer-melodien" (review of "Zuñi Melodies"), *Vierteljahrsschrift für Musikwissenschaft*, 1892, 1; "Tonsystem und Musik der Siamesen," *Beiträge zur Akustik und Musikwissenschaft*, 3, 1901; "Das Berliner Phonogrammarchiv," *Int. Wochenschrift für Wissenschaft, Kunst und Technik*, 22 Februar, 1908. Franz Boas, "The Central Esquimo," Bureau of Ethnology, Sixth Annual Report, Washington, 1888; "The Kwakiutl Indians," U. S. National Museum, Report for 1895. B. I. Gilman, "Zuñi Melodies," *Journal of American Archeology and Ethnology*, I., Boston, 1891; "Some Psychological Aspects of the Chinese Musical System," *Philosophical Review*, I., Nos. 1 and 2, New York, 1892; "Hopi Songs," *Journal of American Archeology and Ethnology*, V., Boston, 1908. Miss Alice C. Fletcher, "A Study of Omaha Indian Music: With a Report on the Structure of the Music by John C. Fillmore," Peabody Museum, Cambridge, U. S. A., 1893; "The Hako: A Pawnee

Hitherto the study of music has labored under an essential disadvantage compared with that of painting and sculpture. Passing events can not be scrutinized as permanent objects can. Time is lacking for their close determination; and once experienced they become memories only. Precision and revision—twin essentials of science—are possible in observing a combination of color and form, but not of tone. Hence the study of music as we know it is a study of scores. Connoisseurship, pictorial and plastic, has found its material wherever paintings and sculptures exist: musical criticism only where scores exist; that is to say only in modern Europe. In order to bring accurate method to bear on non-European music some means for reproducing it at will is demanded. If we can choose the moment when data of sense are to present themselves we can prepare for their precise registry; and the power to repeat our impressions gives the power to correct them. Such a means has been furnished within our own time and our own country. Chiefly by the aid of the phonograph inquiries into exotic music have within

Ceremony," Bureau of Ethnology, Twenty-second Report, Part 2, Washington, 1903. O. Abraham and E. M. von Hornbostel, "Studien über das Tonsystem und die Musik der Japaner," *Sammelbänder der Int. Musikgesellschaft*, IV., 2, 1903; "Ueber die Bedeutung des Phonographen für vergleichende Musikwissenschaft" and "Phonographierte türkische Melodien," *Zeitschrift für Ethnologie*, XXXVI., 2, 1904; "Phonographierte indische Melodien," *Sammelbänder der Int. Musikgesellschaft*, V., 3, 1904; "Phonographierte Indianer-melodien aus British Columbia," Boas Memorial Volume, New York, 1906. E. M. von Hornbostel, "Phonographierte tunesische Melodien" (1905?); "Notiz über die Musik der Bewohner von Sud Neu Mecklenburg" (1905?); "Ueber den gegenwärtigen Stand der vergleichenden Musikwissenschaft," *Int. Musikgesellschaft*, Basler Kongress, 1906. "Ueber die Musik der Kubu," Städtischer Völkermuseum, Frankfurt, 1908. "Phonographierte melodien aus Madagaskar und Indonesien," Forschungsreise S. M. S. *Planet*, V., 6, Berlin, 1909. Compare also: Charles K. Wead, "Contributions to the History of Musical Scales," U. S. National Museum, Report for 1900. W. C. Sabine, "Melody and the Origin of the Musical Scale," *SCIENCE*, May 29, 1908.

a generation attained the standing of a branch of science.

The closer study of instrumental forms undertaken in England by the late A. J. Ellis in 1885 and carried on by J. P. N. Land in Holland laid the foundation for the new research. Five years later, in 1890, Dr. J. Walter Fewkes, of the Hemenway Southwestern Expedition, first used the phonograph in the study of aboriginal folk lore, and collected the records of American Indian singing which in the following year formed the basis of the writer's study of Zuñi melodies. The notations of singing in Miss Alice Fletcher's monograph on the "Music of the Omaha Indians," published in 1893 with a report by the late J. C. Fillmore on the structure of the music, although made by ear, were based upon years of experience in the field. In later extended studies of Indian life and art by Miss Fletcher, Dr. Boas and Dr. Dorsey the phonograph has aided. The investigation of exotic music had already occupied Professor Carl Stumpf, now of Berlin and lately rector of the university. Professor Stumpf in 1886 made an accurate study by ear ("*gleichsamer phonographische Nachbildungen*") of the singing of Bellakula Indians from British Columbia, in 1892 gave an incisive discussion of the Zuñi melodies, and in 1901 published an extended investigation of Siamese music, based on phonographic records and the examination of instruments. Apart from the writer's volume on "Hopi Songs" (1908) all the other contributions to the phonographic study of the non-European art have come from the Psychologisches Institut of Berlin University, of which Professor Stumpf is director, and are the work of his assistants, Dr. E. M. von Hornbostel and Dr. O. Abraham. Meanwhile collections of phonographic records of exotic music have been founded in Berlin, St. Petersburg, Vienna, Paris, Washington, Chicago, Cambridge and elsewhere.

A body of material has thus been gathered and in part investigated, from which already a rich yield of new views of the art of music and its foundations in the mind of its makers either has been reaped or plainly stands ready for the harvest.

First: Anharmonic structure. As far as is known, true harmony does not exist outside of European music. Harmonic feeling has been attributed to the North American Indians; but it does not express itself in part singing and its existence is not yet satisfactorily established. It now seems altogether probable that in spite of the great development of music elsewhere no peoples but the European have ever based an art of tone upon the disturbance and readjustment of consonant combinations of notes.

Second: the isotonic scale. The initial investigations of Asiatic instruments by Ellis and Land pointed to a new formal principle deeply differentiating the music of east and west. There are neither semi-tones nor whole tones in certain scales of Siam and Java. Instead the octave is divided into equal parts, either five $\frac{2}{5}$ tones or seven $\frac{1}{7}$ tones. Professor Stumpf's later phonographic study confirmed these conclusions. A principle of tone-distance supplants the principle of consonance on which the European musical system is based. Music becomes isotonic instead of diatonic as Europeans have hitherto known it. We seem at last out of hearing of Greek tetrachords, as Stevenson, dropping anchor in the harbor of Apia, felt at last beyond the shadow of the Roman law.

Third: heterophony. A Siamese orchestra plays neither in unison nor in parts, for each of the various instruments takes its own liberties with a melody approximately followed by all. To this musical method Professor Stumpf applies the Platonic term "heterophony," and wonders whether the Siamese do not give us a glimpse of what Greek music actually was—which, as Moritz Hauptmann once remarked, "We now know only from the writings of theorists, *i. e.*, do not know at all." Such a structure results sometimes in unisons, sometimes in parallel intervals, but as often in dissonances either transient or unresolved.

Fourth: neo-tonality. As in European music so in many exotic melodies, though not in all, one note is distinguishable as the principal one. But whatever the European feeling of tonality may be, and the point is not yet clear, the regard for a principal note which

takes its place among some non-European peoples would appear a widely different thing. In some cases there is no tendency to end on the tonic note. In Kubu scales Dr. von Hornbostel finds absolute pitch an element. There remain the instances like that of Javese music in which no principal note is discoverable at all. New musical factors reaching deep into the heart of the art, seem revealed in these fundamental divergences.

Fifth: rhythmic complication. Hindu and African music is notably distinguished from our own by the greater complication of its rhythms. This often defies notation. Professor Stumpf remarks that a group of African drummers sometimes perform different rhythms simultaneously; as it were a chord of rhythms like the chords of notes to which different performers contribute in harmonic music. For its jejune structure in tone non-European music makes amends by a rhythmic richness beside which that of European music seems in its turn poverty. In Dr. von Hornbostel's words, "The vertical in the score (harmony) is the enemy of the horizontal (rhythm)." It is not impossible that this revelation of elaborate rhythm in non-European music may affect the future development of our own. The east has already profoundly influenced our painting, as it may perhaps, through some view-point hitherto unguessed, yet influence our sculpture.

Sixth: the melody type. For one element in exotic music no recognized counterpart exists in our own, and it is difficult for the European mind to obtain a clear conception of it. This is the Hindu Raga; apparently a type of melody with a delicate and abstract but very definite expressiveness. A certain Raga may, it is said, be attuned only to a certain season or time of day, and may shock the sense at any other time. This is mysterious, but the whole subject of musical expressiveness is wrapped in a mystery which the isolated students who have attacked it inductively are only beginning to enter. How can the choice of a certain step of the scale as tonic determine a "soft Lydian mode" demoralizing to the fancy? Or was modality itself in Greek music a type of melody otherwise determined

and perhaps akin to the Hindu Raga? Why should medieval times have proscribed the major mode as the "*Modus Lascivus*"? In general why should a minor third upward from the tonic sound sad, and downward sound serene? Is the differing imaginative character of different modern keys a fact or a fancy? Do not all consist of the identical scale performed only at a different pitch? That these questions are, in the present state of musical science, unanswerable, evidences the indifferent equipment of Europeans for the study of the Raga. For the present it is another puzzling datum of musical expressiveness which may some day yield an explanation of wide applicability.

Seventh: scale versus song. Still another fundamental difference from European music has been suggested to the writer by the singing of the Pueblo Indians. These musicians do not seem to grasp the notes they utter as steps in any scale at all, but simply as constituents in a familiar sequence of tones, unrolling itself before the memory. This characteristic may prove the differentia of pure song from music as determined by instruments. A scale would then appear the creation of mechanisms giving fixed tones, like the lyre or the panpipes, the voice by itself knowing none. America would appear the continent of song *par excellence*, the one place where instrumental music has never attained a development capable of putting an end to the liberty of the voice. European music, wholly built on instrumental forms, again appears only one among radically distinct varieties of the art of tone.

Hitherto Europeans have believed all this alien music to be rude, primitive and nugatory—an assumption of which the present inquiries amply show the naïveté. The extraordinary exactness of ear and voice revealed in the phonographic records of some Pueblo songs, is matched by the achievements of Siamese musicians in tuning their instruments, as tested by Professor Stumpf. They proved able to approximate more closely to their isotonic scale than our piano tuners commonly do to the European octave. The absolute pitch of panpipes from Melanesia proved so closely

identical with that of others from Java as to suggest an ethnic or historical affinity between their makers. This close identity between instruments of distant countries, discovered after an interval of years, bears strong testimony at once to native skill and to the accuracy of the methods employed in these studies and to the competence of the students.

To much non-European music the word primitive is wholly inapplicable. An immense development has led up to the isotonic octave. The choice of seven steps is referred by Professor Stumpf to mystic ideas of number; but he also suggests that a diatonic scale, the result of tuning by a chain of fourths, may have preceded the Siamese order. If so, the European scale, which still approximates such a tuning, is the less developed of the two. That of eastern Asia is a modification too radical to have completed itself in less than ages of progress.

Besides its frequent high refinement and artificiality, non-European music has an artistic rank of which it is hard for us to convince ourselves. Rank to its makers, be it added at once; and herein lies the widest lesson of the whole inquiry. This may be described in a phrase as the discovery of how great a part is played by the mind in apprehending a work of art; and how little of the veritable creation can often be grasped by an alien. Professor Stumpf cites a striking example. Since c-e-g on our instruments is a major chord and e-g-b a minor, the two sound to us major and minor, respectively, on a Siamese xylophone, where they are, nevertheless, identical combinations. In like manner a comparison of the tone-material in phonographic records with the same melodies heard currently makes it apparent that Europeans apprehend all music in the diatonic terms familiar to their ears. From the first employment of the instrument doubt began to be thrown on the earlier notations by ear which exhibited exotic music generally as a poor relation of the European family. Psychologically, the value of these results as a notable instance of the dependence of sense on fancy is very great. As a discipline in liberal culture compelling us to seek for the standpoint

of other minds, they will be invaluable to all privileged to follow them. It is our own ears that are oftenest at fault when we hear in exotic music only a strident monotony or a dismal uproar to be avoided and forgotten. To most non-Europeans their music is as passionate and sacred as ours to us and among many it is an equally elaborate and all-pervading art.

The influence of European music becomes every day more audible in the singing and playing of non-European peoples. The time seems not far off when the task of dissecting out aboriginal elements will become impossible. As the ornament in Queen Ti's tomb fell to dust at the entry of the explorer, so exotic music is already dying on the ears of its discoverers. The life of the science has inexorable limits, and if it is to yield what it might, the number of those who pursue it and the money at their command must at once be greatly increased. The results of a few years' work by a few students sufficiently show the absorbing interest and the wide-reaching value of the study; and should bring out both material and personal aid in plenty from lovers of music, of ethnology and of the humanities. What men of means or of science will offer their fortunes or themselves for this imperative labor?

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THE RELATIONSHIPS OF THE ESKIMOS OF EAST GREENLAND

DR. W. THALBITZER describes in the "*Meddelelser om Grønland*," Vol. XXVIII., the Amdrup collection from east Greenland, which comprises objects found between the sixty-eighth and seventy-fifth degrees of north latitude. The publication is of great interest, because it brings out conclusively the close relationship between the culture of the northeast coast of Greenland and that of Ellesmere Land, northern Baffin Land and the northwestern part of Hudson Bay. The similarities are so far-reaching that I do not hesitate to express the opinion that the line of migration and cultural connection between northeast Greenland and the more southwest-